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Seed Production in Southwestern Ponderosa Pine on a Sedimentary Soil

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Original estimates of seed production in southwestern ponderosa pine were probably low. In this study, an estimated 350,000 seeds (25 pounds) per acre were produced. This is approximately six times as much as early estimates and about equal to production observed in a virgin stand on basalt-derived soils.

Keywords: *Pinus ponderosa*, seed production, sedimentary soil

Researchers have not agreed on the amount of seed produced by southwestern ponderosa pine (*Pinus ponderosa* var. *scopulorum*). According to Pearson (1950), large crops occasionally yield 10 pounds of seed per acre, but the average is 2 pounds in good years and 3 to 4 pounds in bumper years. Based on Pearson's (1950) estimate that from 4 to 10 pounds of seed per acre are needed for natural regeneration, production in most seed years would be inadequate. However, in a virgin ponderosa pine stand, near Flagstaff, Ariz., Larson and Schubert (1970) found that there were six medium to bumper cone crops in a 10-year period. The amount of seed produced ranged from 5 to 22 pounds per acre for the 6 years.

Methods

This study was conducted on the Apache-Sitgreaves National Forest, 40 miles south of Winslow, Ariz., at an elevation of 6,800 feet. The terrain is mainly level, with sedimentary soils derived from Coconino sandstone. In 1977, 4,800 board feet per acre were removed by logging, leaving approximately 16 seed-bearing trees per acre averaging about 18 inches d.b.h.

The study consisted of four blocks of six, 150-foot-square plots. Plots were separated by 25-foot isolation strips. Three of the blocks were adjacent to each other; the fourth was approximately 1/2-mile away on a similar site.

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Total cone counts were made on each plot, in the spring of 1979, by tallying cones on the ground, and by using binoculars to count cones remaining on the trees (Fowells and Schubert 1956). There were no cones cached by squirrels in the study area. Number of trees, diameter breast height, basal area, number of cones, and amount of seed were calculated on a per acre basis. Seed production was determined using a figure of 46 seeds per cone.² Seedfall on all 24 plots was related to basal area and diameter by regression analysis.

Results and Discussion

Cone and seed production was prolific and variable (table 1). Number of cones per acre, on individual plots, ranged from 3,100 to 18,900 (mean 7,600). Larson and Schubert (1970) considered more than 6,000 cones per acre to be a bumper crop.

²Data collected by W. J. Rietveld, on file at Rocky Mountain Forest and Range Experiment Station, Flagstaff, Ariz.

Table 1.—Mean cone and seed production by d.b.h., basal area, and number of trees per acre on Chevelon Ranger District in 1978

Block No.	No. trees/ acre	d.b.h.	Basal area/ acre	No. cones/ acre	No. seed/ acre
				(M)	(M)
I	21.28	17.63	35.07	5.57	256
II	17.42	18.77	32.58	6.27	288
III	14.52	17.43	24.32	8.22	378
IV	11.62	18.31	20.61	10.37	477
Mean	16.21	18.03	28.14	7.61	350

Seed production, on individual plots, varied from 141,000 to 871,000 per acre (10.1 to 62.2 pounds).³ Mean seedfall per acre (350,000 or 25 pounds) was about 3.5 times the amount estimated necessary for successful natural regeneration on sedimentary soils (Heidmann et al. 1982).

Seed production was not correlated with basal area (fig. 1, $r=0.04$). Two plots with basal areas of approximately 20 square feet per acre each produced about 870,000 seeds per acre, while the plot with the highest basal area (54 square feet) only produced 284,000 seeds per acre (fig. 1).

Although seed production was correlated with diameter (fig. 2, $r=0.49$), it was not strong enough to predict production. The correlation appears to be strongest for trees in the 12- to 19-inch d.b.h. classes. For trees 20 inches d.b.h. and larger, the relationship does not hold (fig. 2).

There also is a negative correlation between numbers of trees per acre and seed production (fig. 3, $r=-0.36$). However, it is not strong enough for predictive purposes either.

Because of the limited nature of this study, it would be unwise to apply the findings to the entire Southwest. Seed production in southwestern ponderosa pine on sedimentary soils, however, is probably greater than estimated by Pearson (1950) and closer to findings by Larson and Schubert (1970) for basalt-derived soils. In this study, an average of 25 pounds of seed per acre was cast, which is approximately six times the amount Pearson (1950) considered to be a bumper crop. The number of cones produced is slightly greater than the 7,500 Larson and Schubert (1970) observed in a bumper year on basaltic soils. Larson and Schubert (1970), however, were working in a virgin stand with about nine more trees per acre and an average diameter almost 5 inches greater than in this study.

Literature Cited

- Fowells, H.A., and G. H. Schubert. 1956. Seed crops of forest trees in the pine region of California. Technical Bulletin 1150, 48 p. U.S. Department of Agriculture, Washington, D.C.
- Heidmann, L. J., Thomas N. Johnsen, Jr., Quinten W. Cole, and George Cullum. 1982. Establishing natural regeneration of ponderosa pine in central Arizona. *Journal of Forestry* 80:77-79.
- Larson, M. M., and Gilbert H. Schubert. 1970. Cone crops of ponderosa pine in central Arizona including the influence of Abert squirrels. USDA Forest Service Research Paper RM-58, 15 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
- Pearson, G. A. 1950. Management of ponderosa pine in the Southwest. Monograph 6, 218 p. U.S. Department of Agriculture, Washington, D.C.

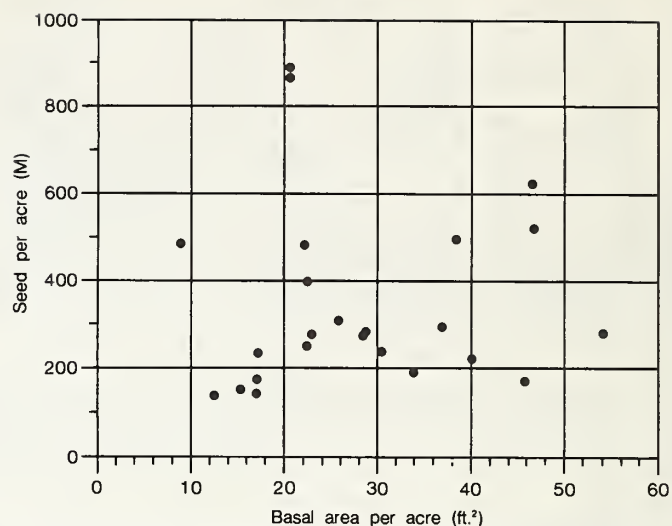


Figure 1.—Relationship between basal area and seed production on natural regeneration study, Apache-Sitgreaves National Forest.

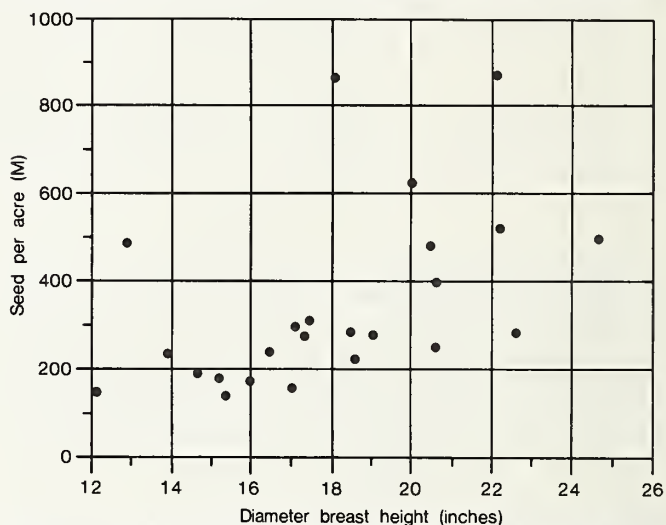


Figure 2.—Relationship between diameter breast height and seed production on natural regeneration study, Apache-Sitgreaves National Forest.

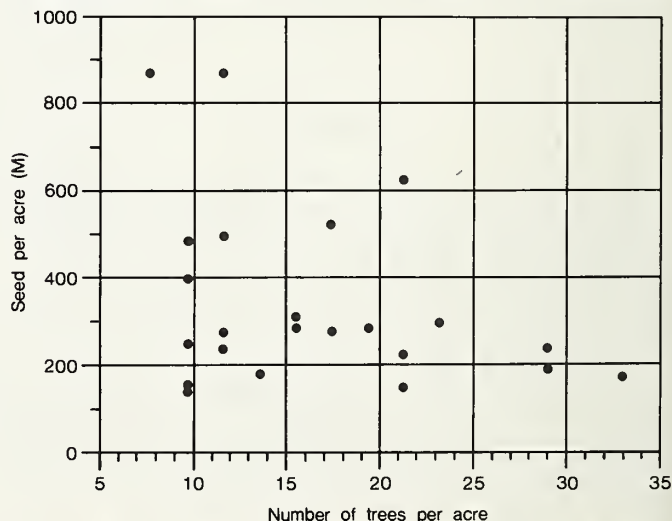


Figure 3.—Relationship between number of trees per acre and seed production on natural regeneration study, Apache-Sitgreaves National Forest.

³Data from Chevelon Ranger District indicates an average of 14,000 seeds per pound.